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- 10 [6,781,599](#) [System and method for visualizing massive multi-digraphs](#)
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- 12 [6,750,901](#) [Digital instant printing camera with image processing capability](#)
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- 16 [6,665,454](#) [Dot adjacency compensation in optical storage systems using ink dots](#)
- 17 [6,644,771](#) [Printing cartridge with radio frequency identification](#)
- 18 [6,636,216](#) [Digital image warping system](#)
- 19 [6,618,117](#) [Image sensing apparatus including a microcontroller](#)
- 20 [6,581,048](#) [3-brain architecture for an intelligent decision and control system](#)

- 21 [6,565,181](#)  [Printing cartridge with switch array identification](#)
- 22 [6,556,983](#)  [Methods and apparatus for finding semantic information, such as usage logs, similar to a query using a pattern lattice data space](#)
- 23 [6,547,364](#)  [Printing cartridge with an integrated circuit device](#)
- 24 [6,542,645](#)  [Adaptive tracking of dots in optical storage system using ink dots](#)
- 25 [6,493,866](#)  [Phase-shift lithography mapping and apparatus](#)
- 26 [6,476,863](#)  [Image transformation means including user interface](#)
- 27 [6,460,036](#)  [System and method for providing customized electronic newspapers and target advertisements](#)
- 28 [6,459,495](#)  [Dot center tracking in optical storage systems using ink dots](#)
- 29 [6,452,596](#)  [Methods and apparatus for the efficient compression of non-manifold polygonal meshes](#)
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- 33 [6,415,054](#)  [Target detection for dot region alignment in optical storage systems using ink dots](#)
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- 35 [6,400,846](#)  [Method for ordering image spaces to search for object surfaces](#)
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- 38 [6,362,868](#)  [Print media roll and ink replaceable cartridge](#)
- 39 [6,356,715](#)  [Prints remaining indicating for camera with variable length print capability](#)
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- 43 [6,312,980](#)  [Programmable triangular shaped device having variable gain](#)
- 44 [6,307,964](#)  [Method for ordering image spaces to represent object shapes](#)
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- 48 [6,102,958](#)  [Multiresolutional decision support system](#)
- 49 [6,097,073](#)  [Triangular semiconductor or gate](#)
- 50 [6,029,195](#)  [System for customized electronic identification of desirable objects](#)

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PAT. NO.	Title
51 5,973,376	<a href="#">Architecture having diamond shaped or parallelogram shaped cells</a>
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53 5,872,380	<a href="#">Hexagonal sense cell architecture</a>
54 5,864,165	<a href="#">Triangular semiconductor NAND gate</a>
55 5,861,885	<a href="#">Method and apparatus for indicating selected objects by spotlight</a>
56 5,835,087	<a href="#">System for generation of object profiles for a system for customized electronic identification of desirable objects</a>
57 5,834,821	<a href="#">Triangular semiconductor "AND" gate device</a>
58 5,822,214	<a href="#">CAD for hexagonal architecture</a>
59 5,811,863	<a href="#">Transistors having dynamically adjustable characteristics</a>
60 5,808,330	<a href="#">Polydirectional non-orthogonal three layer interconnect architecture</a>
61 5,801,422	<a href="#">Hexagonal SRAM architecture</a>
62 5,789,770	<a href="#">Hexagonal architecture with triangular shaped cells</a>
63 5,787,010	<a href="#">Enhanced dynamic programming method for technology mapping of combinational logic circuits</a>
64 5,777,360	<a href="#">Hexagonal field programmable gate array architecture</a>
65 5,754,939	<a href="#">System for generation of user profiles for a system for customized electronic identification of desirable objects</a>
66 5,754,938	<a href="#">Pseudonymous server for system for customized electronic identification of desirable objects</a>
67 5,742,086	<a href="#">Hexagonal DRAM array</a>
68 5,671,381	<a href="#">Method and apparatus for displaying data within a three-dimensional information landscape</a>

69 [5,533,016](#)  [Communications network ring router](#)

70 [5,379,231](#)  [Method and apparatus for simulating a microelectric interconnect circuit](#)

71 [5,113,523](#)  [High performance computer system](#)

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73 [4,295,218](#)  [Error-correcting coding system](#)

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### 1 [Efficient parallel shortest-paths in digraphs with a separator decomposition](#)

Edith Cohen

 August 1993 **Proceedings of the fifth annual ACM symposium on Parallel algorithms and architectures**

Full text available: pdf(1.21 MB)

 Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

### 2 [Session 9C: Labeling schemes for small distances in trees](#)

Stephen Alstrup, Philip Bille, Theis Rauhe

 January 2003 **Proceedings of the fourteenth annual ACM-SIAM symposium on Discrete algorithms**

Full text available: pdf(1.13 MB)

 Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We consider labeling schemes for trees, supporting various relationships between nodes at small distance. For instance, we show that given a tree  $T$  and an integer  $k$  we can assign labels to each node of  $T$  such that given the label of two nodes we can decide, from these two labels alone, if the distance between  $v$  and  $w$  is at most  $k$  and if so compute it. For trees with  $n$  nodes and  $k \geq 2$ , we give a lower bound on the maximum label length of ...

### 3 [A graph-constructive approach to solving systems of geometric constraints](#)

Ioannis Fudos, Christoph M. Hoffmann

 April 1997 **ACM Transactions on Graphics (TOG)**, Volume 16 Issue 2

Full text available: pdf(593.07 KB)

 Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

A graph-constructive approach to solving systems of geometric constraints capable of efficiently handling well-constrained, overconstrained, and underconstrained configurations is presented. The geometric constraint solver works in two phases: in the analysis phase the constraint graph is analyzed and a sequence of elementary construction steps is derived, and then in the construction phase the sequence of construction steps is actually carried out. The analysis phase of the algorithm is de ...

**Keywords:** complexity, constraint solving, geometric constraints, graph-based constraint solvers, underconstrained systems

#### 4 Shallow excluded minors and improved graph decompositions

Serge Plotkin, Satish Rao, Warren D. Smith

January 1994 **Proceedings of the fifth annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  pdf(894.68 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

#### 5 Gross motion planning—a survey

Yong K. Hwang, Narendra Ahuja

September 1992 **ACM Computing Surveys (CSUR)**, Volume 24 Issue 3

Full text available:  pdf(6.40 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Motion planning is one of the most important areas of robotics research. The complexity of the motion-planning problem has hindered the development of practical algorithms. This paper surveys the work on gross-motion planning, including motion planners for point robots, rigid robots, and manipulators in stationary, time-varying, constrained, and movable-object environments. The general issues in motion planning are explained. Recent approaches and their performances are briefly described, a ...

**Keywords:** collision detection, computational geometry, implementation, motion planning, obstacle avoidance, path planning, spatial representation

#### 6 Optimal shortest path queries in a simple polygon

L. J. Guibas, J. Hershberger

October 1987 **Proceedings of the third annual symposium on Computational geometry**


Full text available:  pdf(1.68 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Let  $P$  be a simple polygon with  $n$  sides. This paper shows how to preprocess the polygon so that, given two query points  $p$  and  $q$  inside  $P$ , the length of the shortest path inside the polygon from  $p$  to  $q$  can be found in time  $O(n \log n)$ . The path itself must be polygonal and can be extracted in additional time proportional to the number of turns ...

#### 7 Parallel methods for visibility and shortest path problems in simple polygons (preliminary version)

Michael T. Goodrich, Steven B. Shauck, Sumanta Guha

May 1990 **Proceedings of the sixth annual symposium on Computational geometry**

Full text available:  pdf(995.44 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

In this paper we give efficient parallel algorithms for solving a number of visibility and shortest path problems for simple polygons. Our algorithms all run in  $O(n \log n)$  time and are based on the use of a new data structure for implicitly representing all shortest paths in a simple polygon  $P$ , which we call the stratified decomposition tree. We use this approach to derive efficient parallel methods for computing the visibility ...

#### 8 Compact oracles for reachability and approximate distances in planar digraphs

Mikkel Thorup

November 2004 **Journal of the ACM (JACM)**, Volume 51 Issue 6

Full text available:  pdf(375.48 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

It is shown that a planar digraph can be preprocessed in near-linear time, producing a near-linear space oracle that can answer reachability queries in constant time. The oracle

can be distributed as an  $O(\log n)$  space label for each vertex and then we can determine if one vertex can reach another considering their two labels only. The approach generalizes to give a near-linear space approximate distances oracle for a weighted planar digraph. With weights drawn from  $\mathbb{R}^+$ , ...

**Keywords:** Planar graphs, reachability and shortest paths oracles

## 9 Routing II: Tree based MPLS routing

Anupam Gupta, Amit Kumar, Mikkel Thorup

June 2003 **Proceedings of the fifteenth annual ACM symposium on Parallel algorithms and architectures**

Full text available:  pdf(122.41 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

MPLS (MultiProtocol Label Switching) is a new technology proposed by the IETF [4,10] for network routing, and is being increasingly deployed by the largest Internet service providers. The MPLS technology differs from conventional network protocols in a crucial way: instead of reading the entire packet header at all switching points, the analysis of the packet header is done just *once*, when the packet header is assigned a *stack of labels*, and thenceforth, each switching point or rou ...

**Keywords:** MPLS routing, networks, routing algorithms

## 10 Algorithms 1: I/O-efficient topological sorting of planar DAGs

Lars Arge, Laura Toma, Norbert Zeh

June 2003 **Proceedings of the fifteenth annual ACM symposium on Parallel algorithms and architectures**

Full text available:  pdf(330.43 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)


We present algorithms that solve a number of fundamental problems on planar directed graphs (planar digraphs) in  $O((N))$  I/Os, where  $(N)$  is the number of I/Os needed to sort  $N$  elements. The problems we consider are breadth-first search, the single-source shortest path problem, computing a directed ear decomposition of a strongly connected planar digraph, computing an open directed ear decomposition of a strongly connected biconnected planar digraph, and topologically sorting ...

**Keywords:** I/O-efficient algorithms, ear decomposition, graph algorithms, planar directed graphs, topological sorting

## 11 Combinational logic synthesis for LUT based field programmable gate arrays

Jason Cong, Yuzheng Ding

April 1996 **ACM Transactions on Design Automation of Electronic Systems (TODAES)**, Volume 1 Issue 2

Full text available:  pdf(628.91 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

The increasing popularity of the field programmable gate-array (FPGA) technology has generated a great deal of interest in the algorithmic study and tool development for FPGA-specific design automation problems. The most widely used FPGAs are LUT based FPGAs, in which the basic logic element is a K-input one-output lookup-table (LUT) that can implement any Boolean function of up to K variables. This unique feature of the LUT has brought new challenges to lo ...

**Keywords:** FPGA, area minimization, computer-aided design of VLSI, decomposition, delay minimization, delay modeling, logic optimization, power minimization, programmable logic, routing, simplification, synthesis, system design, technology mapping




- 12 A polynomial-time approximation scheme for weighted planar graph TSP  
 Sanjeev Arora, Michelangelo Grigni, David Karger, Philip Klein, Andrzej Woloszyn  
 January 1998 **Proceedings of the ninth annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  pdf(945.58 KB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

- 13 The Quadtree and Related Hierarchical Data Structures  
 Hanan Samet  
 June 1984 **ACM Computing Surveys (CSUR)**, Volume 16 Issue 2

Full text available:  pdf(4.87 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

- 14 On randomization in sequential and distributed algorithms  
 Rajiv Gupta, Scott A. Smolka, Shaji Bhaskar  
 March 1994 **ACM Computing Surveys (CSUR)**, Volume 26 Issue 1

Full text available:  pdf(8.01 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Probabilistic, or randomized, algorithms are fast becoming as commonplace as conventional deterministic algorithms. This survey presents five techniques that have been widely used in the design of randomized algorithms. These techniques are illustrated using 12 randomized algorithms—both sequential and distributed— that span a wide range of applications, including: primality testing (a classical problem in number theory), interactive probabilistic proofs ...

**Keywords:** Byzantine agreement, CSP, analysis of algorithms, computational complexity, dining philosophers problem, distributed algorithms, graph isomorphism, hashing, interactive probabilistic proof systems, leader election, message routing, nearest-neighbors problem, perfect hashing, primality testing, probabilistic techniques, randomized or probabilistic algorithms, randomized quicksort, sequential algorithms, transitive tournaments, universal hashing

- 15 Efficient and practical modular decomposition  
 Elias Dahlhaus, Jens Gustedt, Ross M. McConnell  
 January 1997 **Proceedings of the eighth annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  pdf(1.22 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

- 16 Session 7B: Bypassing the embedding: algorithms for low dimensional metrics  
 Kunal Talwar  
 June 2004 **Proceedings of the thirty-sixth annual ACM symposium on Theory of computing**

Full text available:  pdf(249.41 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The *doubling dimension* of a metric is the smallest  $k$  such that any ball of radius  $2r$  can be covered using  $2^k$  balls of radius  $r$ . This concept for abstract metrics has been proposed as a natural analog to the dimension of a Euclidean space. If we could embed metrics with low doubling dimension into low dimensional Euclidean spaces, they would inherit several


algorithmic and structural properties of the Euclidean spaces. Unfortunately however, such a restriction on dimension does ...

**Keywords:** PTAS, TSP, distance labels, doubling metrics, routing schemes

### 17 Subgraph isomorphism in planar graphs and related problems

David Eppstein

January 1995 **Proceedings of the sixth annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  pdf(1.08 MB)


Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)



### 18 Improved distributed algorithms for coloring and network decomposition problems

Alessandro Panconesi, Aravind Srinivasan

July 1992 **Proceedings of the twenty-fourth annual ACM symposium on Theory of computing**

Full text available:  pdf(1.04 MB)


Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)



### 19 Efficient sequential and parallel algorithms for computing recovery points in trees and paths

Marek Chrobak, David Eppstein, Giuseppe F. Italiano, Moti Yung

March 1991 **Proceedings of the second annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  pdf(1.07 MB)

Additional Information: [full citation](#), [references](#), [index terms](#)



### 20 Special Issue on learning theory: Path kernels and multiplicative updates

Eiji Takimoto, Manfred K. Warmuth

December 2003 **The Journal of Machine Learning Research**, Volume 4

Full text available:  pdf(353.20 KB)

Additional Information: [full citation](#), [abstract](#), [index terms](#)



Kernels are typically applied to linear algorithms whose weight vector is a linear combination of the feature vectors of the examples. On-line versions of these algorithms are sometimes called "additive updates" because they add a multiple of the last feature vector to the current weight vector. In this paper we have found a way to use special convolution kernels to efficiently implement "multiplicative" updates. The kernels are defined by a directed graph. Each edge contributes an input. The inp ...

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## 21 [Preprocessing an undirected planar network to enable fast approximate distance queries](#)

Philip Klein

January 2002

**Proceedings of the thirteenth annual ACM-SIAM symposium on Discrete algorithms**

 Full text available: [pdf\(639.60 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#)

We describe a method for preprocessing a weighted planar undirected graph and representing the results of the preprocessing so as to facilitate subsequent approximate distance queries. For any  $0 < \epsilon < 1/10$ , a representation can be constructed so that computing an  $\epsilon$ -approximate distance from one node to another takes  $O(\epsilon^{-1})$  time, principally consisting of about  $15\epsilon^{-1}$  additions. The representation requires storage of  $7.2\epsilon$

## 22 [Spanning trees short or small](#)

R. Ravi, R. Sundaram, M. V. Marathe, D. J. Rosenkrantz, S. S. Ravi

January 1994

**Proceedings of the fifth annual ACM-SIAM symposium on Discrete algorithms**

 Full text available: [pdf\(1.14 MB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

## 23 [On approximating arbitrary metrics by tree metrics](#)

Yair Bartal

May 1998

**Proceedings of the thirtieth annual ACM symposium on Theory of computing**

 Full text available: [pdf\(4.11 MB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

## 24 [Multicommodity max-flow min-cut theorems and their use in designing approximation algorithms](#)

Tom Leighton, Satish Rao

 November 1999 **Journal of the ACM (JACM)**, Volume 46 Issue 6


 Full text available: [pdf\(318.22 KB\)](#) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#), [review](#)
**Keywords:** VLSI layout, approximation algorithms, divide and conquer, graph bisection,

graph partitioning, maximum flow, minimum cut, muticommocity flow, routing

## 25 Work-preserving emulations of fixed-connection networks

Richard R. Koch, F. T. Leighton, Bruce M. Maggs, Satish B. Rao, Arnold L. Rosenberg, Eric J. Schwabe

January 1997 **Journal of the ACM (JACM)**, Volume 44 Issue 1

Full text available:  pdf(719.89 KB) Additional Information: [full citation](#), [references](#), [citing](#), [index terms](#), [review](#)

**Keywords:** graph embeddings, network emulations, parallel architectures, processor arrays

## 26 A software engineering perspective on algorithmics

Karsten Weihe

March 2001 **ACM Computing Surveys (CSUR)**, Volume 33 Issue 1

Full text available:  pdf(1.62 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#), [review](#)

An algorithm component is an implementation of an algorithm which is not intended to be a stand-alone module, but to perform a specific task within a large software package or even within several distinct software packages. Therefore, the design of algorithm components must also incorporate software-engineering aspects. A key design goal is adaptability. This goal is important for maintenance throughout a project, prototypical development, and reuse in new, unforeseen context ...

**Keywords:** algorithm engineering

## 27 The complexity of acyclic conjunctive queries

May 2001 **Journal of the ACM (JACM)**, Volume 48 Issue 3

Full text available:  pdf(566.16 KB) Additional Information: [full citation](#), [references](#), [citing](#), [index terms](#), [review](#)

**Keywords:** CSP, LOGCFL, acyclic hypergraph, algorithm, bounded treewidth, conjunctive query, constraint, constraint satisfaction problem, database theory, degree of cyclicity, hinge, join tree, parallel algorithm, query containment, query-idh, subsumption, tree query

## 28 Distance labeling in graphs

Cyril Gavoille, David Peleg, Stéphane Pérennes, Ran Raz

January 2001 **Proceedings of the twelfth annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  pdf(816.02 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citing](#), [index terms](#)

We consider the problem of labeling the nodes of a graph in a way that will allow one to compute the distance between any two nodes directly from their labels (without using any additional information). Our main interest is in the minimal length of labels needed in different cases. We obtain upper bounds and (most importantly) lower bounds for several interesting families of graphs. In particular, our main results are the following:


- For general graphs, the length needed is  $\Theta(\log n)$  ...

## 29 Heuristics, Experimental Subjects, and Treatment Evaluation in Bigraph Crossing Minimization

Matthias Stallmann, Franc Brglez, Debabrata Ghosh

January 2001 **Journal of Experimental Algorithmics (JEA)**, Volume 6

Full text available:  [pdf\(858.74 KB\)](#)

 [ps\(3.01 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The bigraph crossing problem, embedding the two node sets of a bipartite graph along two parallel lines so that edge crossings are minimized, has applications to circuit layout and graph drawing. Experimental results for several previously known and two new heuristics suggest continued exploration of the problem, particularly sparse instances. We emphasize careful design of experimental subject classes and present novel views of the results. All source code, data, and scripts are available on-li ...

**Keywords:** crossing number, design of experiments, graph drawing, graph embedding, graph equivalence classes, layout

## 30 Divide-and-conquer approximation algorithms via spreading metrics

Guy Even, Joseph Seffi Naor, Satish Rao, Baruch Schieber

July 2000 **Journal of the ACM (JACM)**, Volume 47 Issue 4

Full text available:  [pdf\(320.60 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

We present a novel divide-and-conquer paradigm for approximating NP-hard graph optimization problems. The paradigm models graph optimization problems that satisfy two properties: First, a divide-and-conquer approach is applicable. Second, a fractional spreading metric is computable in polynomial time. The spreading metric assigns lengths to either edges or vertices of the input graph, such that all subgraphs for which the optimization problem is nontrivial have large diameters. In addition, ...

**Keywords:** approximation algorithms, divide and conquer, feedback set, linear arrangement, multicut, spreading metrics

## 31 A tree-edit-distance algorithm for comparing simple, closed shapes

Philip Klein, Srikanta Tirhapura, Daniel Sharvit, Ben Kimia

February 2000 **Proceedings of the eleventh annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  [pdf\(817.16 KB\)](#)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

## 32 Existential second-order logic over graphs: Charting the tractability frontier

Georg Gottlob, Phokion G. Kolaitis, Thomas Schwentick

March 2004 **Journal of the ACM (JACM)**, Volume 51 Issue 2

Full text available:  [pdf\(409.27 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Fagin's theorem, the first important result of descriptive complexity, asserts that a property of graphs is in NP if and only if it is definable by an existential second-order formula. In this article, we study the complexity of evaluating existential second-order formulas that belong to *prefix classes* of existential second-order logic, where a prefix class is the collection of all existential second-order formulas in prenex normal form such that the second-order and the first-order quan ...

**Keywords:** Existential second-order logic, NP-complete problems, finite model theory, graph coloring, graph constraints, prefix classes

### 33 Fast detection of communication patterns in distributed executions

Thomas Kunz, Michiel F. H. Seuren

November 1997 **Proceedings of the 1997 conference of the Centre for Advanced Studies on Collaborative research**

Full text available:  pdf(4.21 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Understanding distributed applications is a tedious and difficult task. Visualizations based on process-time diagrams are often used to obtain a better understanding of the execution of the application. The visualization tool we use is Poet, an event tracer developed at the University of Waterloo. However, these diagrams are often very complex and do not provide the user with the desired overview of the application. In our experience, such tools display repeated occurrences of non-trivial commun ...

### 34 New graph decompositions and fast emulations in hypercubes and butterflies

Christos Kaklamanis, Danny Krizanc, Satish Rao

August 1993 **Proceedings of the fifth annual ACM symposium on Parallel algorithms and architectures**

Full text available:  pdf(958.39 KB) Additional Information: [full citation](#), [references](#), [citing](#), [index terms](#)

### 35 Efficient integration of multihop wireless and wired networks with QoS constraints

Yigal Bejerano

December 2004 **IEEE/ACM Transactions on Networking (TON)**, Volume 12 Issue 6

Full text available:  pdf(793.76 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This study considers the problem of designing an efficient and low-cost infrastructure for connecting static multihop wireless networks with wired backbone, while ensuring QoS requirements such as bandwidth and delay. This infrastructure is useful for designing low-cost and fast deployed access networks in rural and suburban areas. It may also be used for providing access to sensor networks or for efficient facility placement in wireless networks. In these networks, some nodes are chosen as acce ...

**Keywords:** approximation algorithms, clustering, facility location, sensor networks, unit disk graphs, wireless access network

### 36 Strongly polynomial-time and NC algorithms for detecting cycles in periodic graphs

Edith Cohen, Nimrod Megiddo

September 1993 **Journal of the ACM (JACM)**, Volume 40 Issue 4

Full text available:  pdf(2.88 MB) Additional Information: [full citation](#), [references](#), [citing](#), [index terms](#), [review](#)

**Keywords:** application of multidimensional search, application of parametric method, strongly polynomial algorithms periodic graphs

### 37 The freeze-tag problem: how to wake up a swarm of robots

Esther M. Arkin, Michael A. Bender, Sándor P. Fekete, Joseph S. B. Mitchell, Martin Skutella

January 2002 **Proceedings of the thirteenth annual ACM-SIAM symposium on Discrete algorithms**


Full text available:  pdf(1.11 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#)

An optimization problem that naturally arises in the study of "swarm robotics" is to wake up a set of "asleep" robots, starting with only one "awake" robot. One robot can only awaken another when they are in the same location. As soon as a robot is awake, it assists in waking up other robots. The goal is to compute an optimal *awakening schedule* such that all robots are awake by time  $t^*$ , for the smallest possible value of  $t^*$ . We consider both scenarios on graphs and in geometr ...

### 38 [Three-dimensional medical imaging: algorithms and computer systems](#)

M. R. Stytz, G. Frieder, O. Frieder

December 1991 **ACM Computing Surveys (CSUR)**, Volume 23 Issue 4


Full text available:  pdf(7.38 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#), [review](#)

**Keywords:** Computer graphics, medical imaging, surface rendering, three-dimensional imaging, volume rendering

### 39 [Polylog-time and near-linear work approximation scheme for undirected shortest paths](#)

Edith Cohen

January 2000 **Journal of the ACM (JACM)**, Volume 47 Issue 1

Full text available:  pdf(311.19 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Shortest paths computations constitute one of the most fundamental network problems. Nonetheless, known parallel shortest-paths algorithms are generally inefficient: they perform significantly more work (product of time and processors) than their sequential counterparts. This gap, known in the literature as the "transitive closure bottleneck," poses a long-standing open problem. Our main result is an  $O(m^{1/2} + s)$

### 40 [Index-driven similarity search in metric spaces](#)

Gisli R. Hjaltason, Hanan Samet

December 2003 **ACM Transactions on Database Systems (TODS)**, Volume 28 Issue 4

Full text available:  pdf(650.64 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Similarity search is a very important operation in multimedia databases and other database applications involving complex objects, and involves finding objects in a data set  $S$  similar to a query object  $q$ , based on some similarity measure. In this article, we focus on methods for similarity search that make the general assumption that similarity is represented with a distance metric  $d$ . Existing methods for handling similarity search in this setting typically fall into one of ...

**Keywords:** Hierarchical metric data structures, distance-based indexing, nearest neighbor queries, range queries, ranking, similarity searching

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#### 41 [Nonplanar topological inference and political-map graphs](#)

Zhi-Zhong Chen, Xin He, Ming-Yang Kao

 January 1999 **Proceedings of the tenth annual ACM-SIAM symposium on Discrete algorithms**

Full text available: pdf(1.24 MB)

 Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

#### 42 [A decomposition of multidimensional point sets with applications to k-nearest-neighbors and n-body potential fields](#)

Paul B. Callahan, S. Rao Kosaraju

 January 1995 **Journal of the ACM (JACM)**, Volume 42 Issue 1

Full text available: pdf(1.85 MB)

 Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We define the notion of a well-separated pair decomposition of points in d-dimensional space. We then develop efficient sequential and parallel algorithms for computing such a decomposition. We apply the resulting decomposition to the efficient computation of k-nearest neighbors and n-body potential fields.

**Keywords:** all nearest neighbors, fast multipole method

#### 43 [Hierarchical vertical decompositions, ray shooting, and circular arc queries in simple polygons](#)

Siu-Wing Cheng, Hazel Everett, Otfried Cheong, René van Oostrum

 June 1999 **Proceedings of the fifteenth annual symposium on Computational geometry**

Full text available: pdf(1.08 MB)

 Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

#### 44 [Technical papers: program analysis: Efficient path conditions in dependence graphs](#)

Torsten Robschink, Gregor Snelting

 May 2002 **Proceedings of the 24th International Conference on Software Engineering**

Full text available: pdf(1.18 MB)

 Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)




Program slicing combined with constraint solving is a powerful tool for software analysis. Path conditions are generated for a slice or chop, which --- when solved for the input variables --- deliver compact "witnesses" for dependences or illegal influences between program points. In this contribution we show how to make path conditions work for large programs. Aggressive engineering, based on interval analysis and BDDs, is shown to overcome the potential combinatoric explosion. Case studies and ...

#### 45 A survey of graph layout problems

Josep Díaz, Jordi Petit, Maria Serna

September 2002 **ACM Computing Surveys (CSUR)**, Volume 34 Issue 3

Full text available:  pdf(1.47 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Graph layout problems are a particular class of combinatorial optimization problems whose goal is to find a linear layout of an input graph in such way that a certain objective cost is optimized. This survey considers their motivation, complexity, approximation properties, upper and lower bounds, heuristics and probabilistic analysis on random graphs. The result is a complete view of the current state of the art with respect to layout problems from an algorithmic point of view.

**Keywords:** Approximation algorithms, complexity, embedding, heuristics, layout, parameterized complexity, random graphs

#### 46 Storing a collection of polygons using quadtrees

Hanan Samet, Robert E. Webber

July 1985 **ACM Transactions on Graphics (TOG)**, Volume 4 Issue 3

Full text available:  pdf(3.00 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


An adaptation of the quadtree data structure that represents polygonal maps (i.e., collections of polygons, possibly containing holes) is described in a manner that is also useful for the manipulation of arbitrary collections of straight line segments. The goal is to store these maps without the loss of information that results from digitization, and to obtain a worst-case execution time that is not overly sensitive to the positioning of the map. A regular decomposition variant of the region ...

**Keywords:** geographic information, hierarchical data structures, line representations, map overlay, polygonal representations, quadtrees

#### 47 On finding minimal 2-connected subgraphs

Pierre Kelsen, Vijaya Ramachandran

March 1991 **Proceedings of the second annual ACM-SIAM symposium on Discrete algorithms**


Full text available:  pdf(1.10 MB)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

#### 48 Session 1C: Sublogarithmic approximation for telephone multicast: path out of jungle (extended abstract)

Michael Elkin, Guy Kortsarz

January 2003 **Proceedings of the fourteenth annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  pdf(1.02 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)


Consider a network of processors modeled by an  $n$ -vertex graph  $G = (V, E)$ . Assume that

the communication in the network is synchronous, i.e., occurs in discrete "rounds", and in every round every processor is allowed to pick one of its neighbors, and to send it a message. The *telephone k-multicast* problem requires to compute a schedule with minimal number of rounds that delivers a message from a given single processor, that generates the message, to all the proc ...

#### 49 Computational strategies for object recognition

Paul Suetens, Pascal Fua, Andrew J. Hanson

March 1992 **ACM Computing Surveys (CSUR)**, Volume 24 Issue 1

Full text available:  pdf(6.37 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

This article reviews the available methods for automated identification of objects in digital images. The techniques are classified into groups according to the nature of the computational strategy used. Four classes are proposed: (1) the simplest strategies, which work on data appropriate for feature vector classification, (2) methods that match models to symbolic data structures for situations involving reliable data and complex models, (3) approaches that fit models to the photometry and ...

**Keywords:** image understanding, model-based vision, object recognition

#### 50 On Gazit and Miller's parallel algorithm for planar separators: achieving greater efficiency through random sampling

Philip Klein

August 1993 **Proceedings of the fifth annual ACM symposium on Parallel algorithms and architectures**


Full text available:  pdf(838.18 KB)

Additional Information: [full citation](#), [references](#), [index terms](#)

#### 51 Average case analysis of dynamic graph algorithms

David Alberts, Monika Rauch Henzinger

January 1995 **Proceedings of the sixth annual ACM-SIAM symposium on Discrete algorithms**


Full text available:  pdf(1.33 MB)

Additional Information: [full citation](#), [references](#), [citations](#)

#### 52 Behavioral synthesis of field programmable analog array circuits

Haibo Wang, Sarma B. K. Vrudhula

October 2002 **ACM Transactions on Design Automation of Electronic Systems (TODAES)**, Volume 7 Issue 4

Full text available:  pdf(519.64 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

This article presents methods to translate a behavioral-level analog description into a Field Programmable Analog Array (FPAA) implementation. The methods consist of several steps that are referred to as function decomposition, macrocell synthesis, placement and routing, and postplacement simulation. The focus of this article is on the first three steps. The function decomposition step deals with decomposing a high-order system function into a set of lower-order functions. We present an efficient ...

**Keywords:** Programmable circuits, analog synthesis

#### 53

Linear time algorithms for visibility and shortest path problems inside simple polygons

L Guibas, J Hershberger, D Leven, M Sharir, R Tarjan

August 1986 **Proceedings of the second annual symposium on Computational geometry**

Full text available:  [pdf\(1.20 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We present linear time algorithms for solving the following problems involving a simple planar polygon  $P$ : (i) Computing the collection of all shortest paths inside  $P$  from a given source vertex  $s$  to all the other vertices of  $P$ ; (ii) Computing the subpolygon of  $P$  consisting of points that are visible from a segment within  $P$ ; (iii) Preprocessing  $P$  so that for any query ray

**54** The weighted region problem: finding shortest paths through a weighted planar subdivision

Joseph S. B. Mitchell, Christos H. Papadimitriou

January 1991 **Journal of the ACM (JACM)**, Volume 38 Issue 1

Full text available:  [pdf\(3.92 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

The problem of determining shortest paths through a weighted planar polygonal subdivision with  $n$  vertices is considered. Distances are measured according to a weighted Euclidean metric: The length of a path is defined to be the weighted sum of (Euclidean) lengths of the subpaths within each region. An algorithm that constructs a (restricted) "shortest path map" with respect to a given source point is presented. The output is a partitioning of each edge of the su ...

**Keywords:** Dijkstra's algorithm, Voronoi diagrams, shortest paths, terrain navigation, weighted distance functions

**55** An  $O(n \log n)$  algorithm for the maximum agreement subtree problem for binary trees

Richard Cole, Ramesh Hariharan

January 1996 **Proceedings of the seventh annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  [pdf\(1.03 MB\)](#)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

**56** Geometric compression through topological surgery

Gabriel Taubin, Jarek Rossignac

April 1998 **ACM Transactions on Graphics (TOG)**, Volume 17 Issue 2

Full text available:  [pdf\(8.98 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The abundance and importance of complex 3-D data bases in major industry segments, the affordability of interactive 3-D rendering for office and consumer use, and the exploitation of the Internet to distribute and share 3-D data have intensified the need for an effective 3-D geometric compression technique that would significantly reduce the time required to transmit 3-D models over digital communication channels, and the amount of memory or disk space required to store the models. Because ...

**Keywords:** 3D mesh compression, VRML, geometry compression

**57** Power minimization in IC design: principles and applications

Massoud Pedram

January 1996 **ACM Transactions on Design Automation of Electronic Systems (TODAES)**, Volume 1 Issue 1

Full text available:  pdf(550.02 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


Low power has emerged as a principal theme in today's electronics industry. The need for low power has caused a major paradigm shift in which power dissipation is as important as performance and area. This article presents an in-depth survey of CAD methodologies and techniques for designing low power digital CMOS circuits and systems and describes the many issues facing designers at architectural, logical, and physical levels of design abstraction. It reviews some of the techniques and tool ...

**Keywords:** CMOS circuits, adiabatic circuits, computer-aided design of VLSI, dynamic power dissipation, energy-delay product, gated clocks, layout, low power layout, low power synthesis, lower-power design, power analysis and estimation, power management, power minimization and management, probabilistic analysis, silicon-on-insulator technology, statistical sampling, switched capacitance, switching activity, symbolic simulation, synthesis, system design

### 58 [Graph-theoretic methods in database theory](#)

Mihalis Yannakakis


April 1990 **Proceedings of the ninth ACM SIGACT-SIGMOD-SIGART symposium on Principles of database systems**

Full text available:  pdf(1.61 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

### 59 [Linear recursive networks and their applications in topological design and data routing](#)

Hsu Wen Jing, Amitabha Das, Moon Jung Chung

October 1993 **ACM SIGCOMM Computer Communication Review , Conference proceedings on Communications architectures, protocols and applications**, Volume 23 Issue 4

Full text available:  pdf(862.76 KB) Additional Information: [full citation](#), [references](#), [index terms](#)

### 60 [Session 7B: A general approach to online network optimization problems](#)

Noga Alon, Baruch Awerbuch, Yossi Azar, Niv Buchbinder, Joseph (Seffi) Naor

January 2004 **Proceedings of the fifteenth annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  pdf(278.89 KB) Additional Information: [full citation](#), [abstract](#), [references](#)

We study a wide range of online graph and network optimization problems, focusing on problems that arise in the study of connectivity and cuts in graphs. In a general online network design problem, we have a communication network known to the algorithm in advance. What is not known in advance are the bandwidth or cut demands between nodes in the network. Our results include an  $O(\log m \log n)$  competitive randomized algorithm for the online non-metric facility location and for ...

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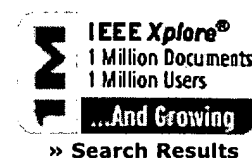
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*Xu, J.Z.; Suk, M.; Ranka, S.;*

Signal Processing, 1996., 3rd International Conference on , Volume: 2 , 14-18 Oct. 1996

Pages:926 - 929 vol.2

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*McCreary, C.L.; Chapman, R.O.; Shieh, F.-S.;*

Systems, Man and Cybernetics, Part A, IEEE Transactions on , Volume: 28 , Issue: 5 , Sept. 1998

Pages:545 - 561

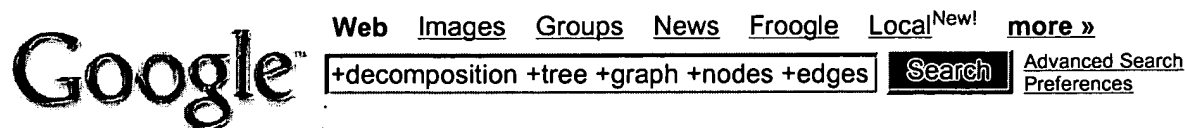
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**3 A new algorithm for transitive closures and computation of recursion in relational databases**
*Yangjun Chen;*

Information Visualization, 2003. IV 2003. Proceedings. Seventh International Conference on , 16-18 July 2003

Pages:206 - 213

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### LAUPACK - Graph routines by Hang Tong Lau

DECOMP does **path decomposition** for a planarity test ..... finds a maximum cardinality matching in a **graph**. GRAPH\_ARC\_MINTR2 finds the minimum spanning **tree** of a **graph** ...

[www.csit.fsu.edu/~burkardt/f\\_src/laupack/laupack.html](http://www.csit.fsu.edu/~burkardt/f_src/laupack/laupack.html) - 9k - [Cached](#) - [Similar pages](#)

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Can take the **decomposition** and convert to a **tree**. ..... If we just add over neighbors in the **graph** we get ..... Example 2: suppose we have a complete binary **tree** of **depth** ...

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### [PDF] Preprocessing an undirected planar network to enable fast ...

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There is an entry in  $T_x$  for each **tree**-vertex  $v$  of the **decomposition** for which  $N(v)$  contains the **graph** node  $x$ . 3 The entry of  $T_x$  corresponding to  $v$  is a ...

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### [PDF] A Polynomial-Time Approximation Scheme for Weighted Planar Graph ...

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... be a subgraph arising in the hierarchical **decomposition** of the ..... induced by cutting the shortest-**path tree** at **distance**  $d$  .... the embedding of the planar **graph** in such ...

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### [PDF] A Polynomial-Time Approximation Scheme for Weighted Planar Graph ...

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... times the cost of a minimum spanning **tree** in the ....  $k^n$ . Summing over all levels of the **decomposition**, we obtain .... this tour back to the original **graph** as follows.

[www.mathcs.emory.edu/~mic/papers/12.pdf](http://www.mathcs.emory.edu/~mic/papers/12.pdf) - [Similar pages](#)

### Graph Algorithms

We show as a general result that the number of paths in such a **decomposition** can always be limited to  $m$  ..... The minimum spanning **tree** of a weighted **graph** is a ...

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### [PDF] Approximate Cell Decomposition Methods

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undirected **graph**  $G$ : • **nodes** in  $G$  correspond to empty and mixed cells in  $P$  ..... in the worst-case, the **tree** has 2 ... Approx. Cell **Decomposition** Methods [ 7 ] ...

[parasol.tamu.edu/~amato/Courses/padova04/lectures/L4.approx-decomp.pdf](http://parasol.tamu.edu/~amato/Courses/padova04/lectures/L4.approx-decomp.pdf) - [Similar pages](#)

### [PDF] Many-to-Many Feature Matching Using Spherical Coding of Directed ...

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The complete **graph** in (b) captures the Euclidean distances ... while (c) is the metric **tree** representation of the multi-scale **decomposition** (with additional ...

[facweb.cs.depaul.edu/research/vc/publications/fdassdyk1b2004eccv.pdf](http://facweb.cs.depaul.edu/research/vc/publications/fdassdyk1b2004eccv.pdf) - [Similar pages](#)

### [PDF] LNCS 3111 - Collective Tree Spanners of Graphs

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It is easy to see that a balanced **decomposition tree** BT (G) of a **graph** G with ...  
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... branch **distance**" (ie the number of **nodes** between the ...  $r, q, r, i$ ) in the connection  
**graph**. ... computed by recursively traversing the **decomposition tree** until the ...  
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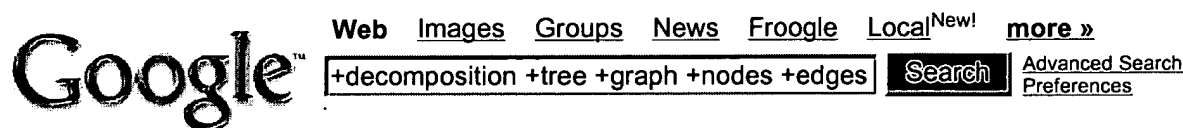
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... terminal **nodes**, we continue MLDA image **decomposition** until all ..... from the starting point in the MLDA **graph** (ie the ... of new **nodes** in the search **tree**) is controlled ...

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... terminal **nodes**, we continue MLDA image **decomposition** until all ..... the starting point in the MLDA **graph** (ie the ... new **nodes** in the search **tree**) is controlled ...

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[PDF] Many-to-Many Graph Matching via Metric Embedding

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Figure 1. **Path** partition of a **tree**. ... level 2 paths, we are left with an empty **graph**. .... coordinates corresponding to the paths in the **decomposition** sequence of □ ...

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... 7–9] examined how to develop **graph**-based data ..... of the leaf **nodes** in a **decomposition tree** would correspond ... proceed with the scale-space **decomposition** of model M ...

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... other than the two labels, regarding the **graph** from which ..... v. It is easy to see that a **decomposition tree** T of a .... NCA-**depth** labeling scheme for a **tree** T with the ...

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In the first pass, the spanning **tree** is constructed. ... computes a k-view of a **graph** G in ... The Network **Decomposition** Problem presented in [6] consists of ...

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[PDF] An Approximation Scheme for Planar Graph TSP

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even subset X of I : Cover the **nodes** of G i ..... Starting from the input **graph** G , we iteratively apply Theorem 2.1 to construct a binary **decomposition tree** ...

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[PDF] CS270 Problem Set 1 – Spring 2005

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Undirected graphs also have a **decomposition** theorem: Every undirected **graph** .... a) In the **graph** below, identify ... a non-root vertex in the **depth**-first search **tree**.



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[PDF] [BHATTt, CHUNG:, LEIGHTON, Many As](#)

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**tree decomposition** .... processor interconnection **graph**. ..... message must traverse. 3. Each hypercube edge is used to route only  $O(1)$  **tree edges** (ie, the congestion ...

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Starting from the input **graph**  $G$ , we iteratively ap- ply Theorem 2.1 to construct a binary **decomposition tree**  $T$  where each ..... spanning **tree** in planar **graph**  $G$  ...

[doi.ieeecomputersociety.org/10.1109/SFCS.1995.492665](http://doi.ieeecomputersociety.org/10.1109/SFCS.1995.492665) - [Similar pages](#)

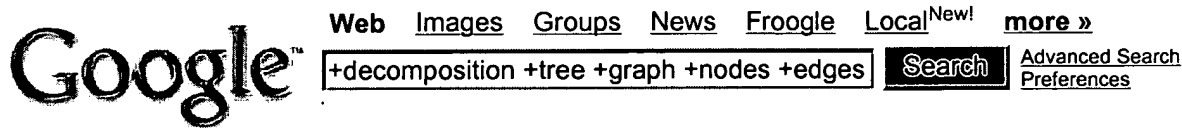
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[PDF] On Applying Separator Decompositions to Path Problems and Network ...

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size, can be transformed into a **tree decomposition** of width ... aid of separator decompositions instead of **tree** decompositions ..... V;E denotes a directed **graph** with ...  
www.library.uu.nl/digiarchief/ dip/dispute/2001-0223-164521/1997-36.pdf - [Similar pages](#)

Jie Gao

A well-separated pair **decomposition** is simply a set of ... pair, diameter, median, minimum spanning/steiner **tree** etc., since .... for any  $>0$ . Such a **graph** is called a (1 ...  
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... graphs 5.2.1 Composition heuristics 5.2.2 **Decomposition** heuristics 5.2 ..... All branches of the **tree** for those the upper .... to find a **path** between two **nodes** in a **graph**.  
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An Efficient Path Computation Model for Hierarchically Structured ...

later proposed a good planar **graph decomposition** algorithm, called spatial ..... part of the level k HiTi **graph** and two level ... We take a level 4 subgraph **tree** in Fig.  
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[PDF] Parallel Methods for Visibility and Shortest Path Problems in ...

File Format: PDF/Adobe Acrobat

... given a triangulated polygon P, the dual **graph** D of ... triangulation, and a (polygon-cutting theorem) **decomposition tree** T for P ... to T for each pair of **nodes** ...  
dx.doi.org/10.1145/98524.98539 - [Similar pages](#)

[PDF] Efficient parallel shortest-paths in digraphs with a separator ...

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... algorithm is based on paralleliz- ing the hammock **decomposition** technique introduced .... of G. The **tree** TG is a rooted binary **tree** with subgraphs ... original **graph**.  
dx.doi.org/10.1145/165231.165240 - [Similar pages](#)

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[PDF] Scale-Space Representation of 3D Models and Topological Matching

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... for mapping a 3D model to a rooted **tree**. ..... also proposed nu- merous frameworks for **graph** matching, including ..... can proceed with scale-space **decomposition** of model M ...  
gicl.cs.drexel.edu/papers/PDFs/p043-bespalov.pdf - [Similar pages](#)

[PDF] Microsoft PowerPoint - Chapter 11 - Search Algorithms for Discrete ...

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Page 11. Trees vs Graphs Exploring a **graph** as if it was a **tree**. Can be a problem... ... Why unstructured? **Decomposition** approaches? Do we do the same work as the ...  
www-users.cs.umn.edu/~karypis/parbook/Lectures/ GK-CS5451/Chapter%2011%20-%20Search%20Algorithms%20for%20D... - [Similar pages](#)

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... is given, otherwise for part b) we could use the algorithm in the book to get a **tree decomposition** of width ... a) We will show that a **graph** with **tree** width  $w$  ...

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... whose prime **nodes** of the **decomposition tree** are "simple ... is closely related to modular **decomposition**, and it ..... on doubly linked lists and the **graph** objects (**nodes** ...

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